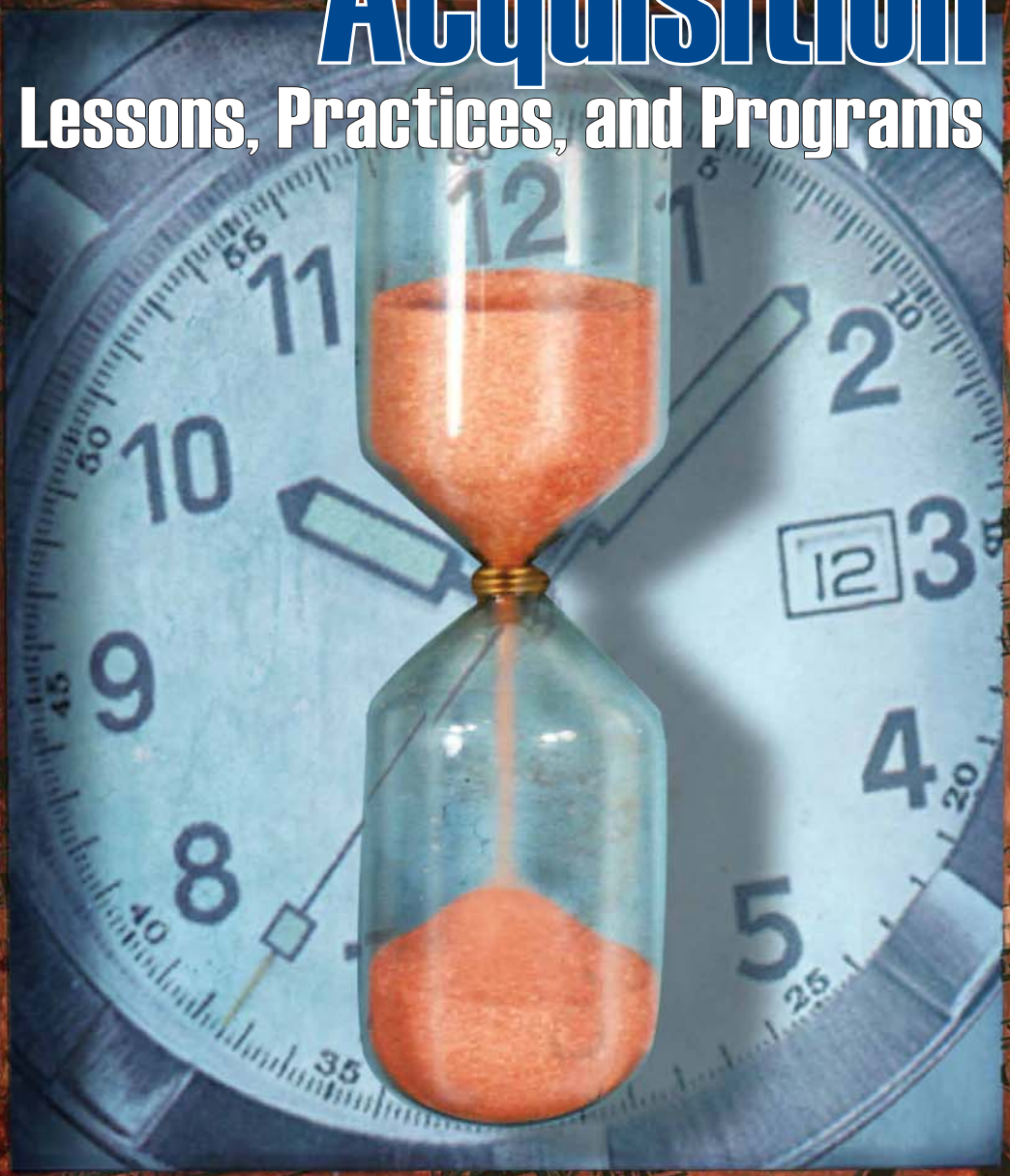
Contracting and Acquisition

Lessons, Practices, and Programs



also in this edition:

Flyaway Costs Versus Individual Components of Aircraft: An Analysis

AFMC/XPS Logistics Analysis

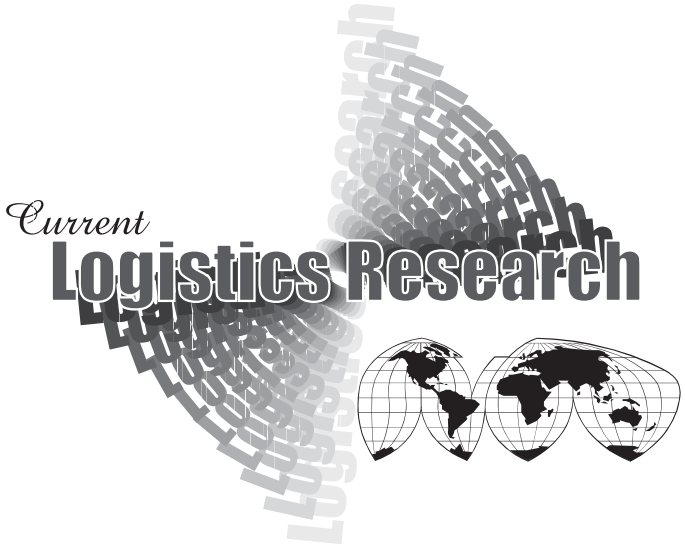
XLog21—Purchasing and Supply Chain Management

Excellence in Writing Contest

http://www.aflma.hq.af.mil/lgj/Afjlhome.html

AIR FORCE JOURNAL of LOGISTICS

Volume XXVII,
Number 4
Winter 2003



AFMC/XPS Logistics Analysis

Richard A. Moore

The history of war proves that nine out of ten times an army has been destroyed because its supply lines have been cut off ....

—General Douglas MacArthur, USA

What is an XPS, and why does it do logistics analysis? In the beloved world of alphabet soup that identifies organizations in the Air Force, XPS is the Management Sciences Division of the Directorate of Plans and Programs (XP) in Headquarters Air Force Materiel Command (AFMC). Now that you really are confused, you should know that management sciences is also known as operations research, and both simply refer to the professional discipline of using analysis to inform decisionmakers.

That tells you what we are but does not tell you why we do logistics analysis. After all, shouldn't an office that is part of an organization doing plans and programs be focused on strategic plans, the program objective memorandum, or manpower? That's typically the business of an XP organization in the Air Force, but because an XP organization also has a corporate perspective and *honest broker* role, XPS is able to help decisionmakers in all AFMC organizations. We focus much of our efforts on logistics because we, like MacArthur, think it is important. And judging by the billions of dollars the Air Force spends annually just buying and repairing spare parts, our senior leaders agree.

This article highlights our work in 2003 to improve the effectiveness and efficiency of logistics in the Air Force. Following is a summary of three of our significant spares management studies and a list of other contributions made toward improving Air Force logistics. Details and points of contact for topics mentioned are available in our 2003 annual report, which can be found at https://www.afmc-mil.wpafb.af.mil/HQ-AFMC/XP/xps/xps_annrep.htm. You may request a printed or electronic copy from Samantha Hetrick (937-257-3887 or samantha.hetrick@wpafb.af.mil).

Customer-Oriented Leveling Technique—Exporting a Capability from the Depots to the Flight Line

In late 2001, we worked with a team from the AFMC Logistics Directorate and air logistics centers (ALC) to develop the customer-oriented leveling technique (COLT) to allocate optimally and execute the depots' $800M annual General Support Division (GSD) budget. The primary supplier of parts bought with GSD funds is the Defense Logistics Agency (DLA). COLT uses sophisticated algorithms to determine the stock levels that will provide the lowest possible expected back orders for a given level of spares funding. By reducing back orders, COLT also reduces the time that people who repair aircraft and aircraft components wait for spare parts (that is, customer wait time [CWT]).

COLT is a departure from the practice of setting stock levels for all DLA-managed parts in exactly the same manner. It incorporates item-specific factors, based on the expected percentage of time DLA will have the parts in stock that the depot requests, as well as the length of time the depot has to wait for parts not immediately issued by DLA. By looking at the total expected pipeline time for each item, COLT is able to tailor stock levels to get the most efficient use of the GSD dollars.

As of December 2003, implementation of COLT has resulted in a 60-percent reduction in the customer wait time for depot maintenance with no increase in cost. Likewise, the quantity of repairs awaiting parts for DLA parts has reduced the same amount. Because of these accomplishments, the COLT Team won the 2003 General Yates Team Excellence Award for AFMC and was nominated for the Chief of Staff Team Excellence Award for the Air Force.

With the tremendous success realized by implementing COLT at the depots, we turned our attention to implementing COLT at the base level where we could have a more direct and significant impact on readiness. Setting base stock levels for DLA parts is not a responsibility of AFMC, so we teamed with the Air Force Logistics Management Agency (AFLMA) and the Air Force Materiel Management and Policy Division to develop any changes in business rules required for the base environment.

COLT was first tested at Seymour Johnson AFB, North Carolina, at Air Combat Command (ACC) in November 2002 and at Laughlin AFB, Texas, for Air Education and Training Command in March 2003. We identified a problem with the funding parameters provided to COLT, and it was agreed that testing would be postponed until further analysis could be completed. We worked with a team, with representatives from all the major commands (MAJCOM), to identify the issues and suggested changes to be implemented before continuing testing. Some of these base-unique changes are summarized in Table 1.

We made these changes to the COLT algorithm and compared the expected performance of COLT to the performance from the computations in the Standard Base Supply System (SBSS). Table 2 shows the expected back orders that are likely to be seen for two different bases.

These improvements are of the same magnitude projected at the beginning of the COLT implementation at the depots and which were later realized. Both ACC and Air Mobility Command agreed to test COLT at their respective bases, Seymour Johnson and Travis AFB, California. The Seymour Johnson test began in October 2003, and the Travis test began in December 2003. We will be working closely with both commands to monitor these

tests throughout 2004. If the results are as predicted, we would like to apply COLT to at least one base in each MAJCOM in fiscal year (FY) 2005 and implement COLT for an entire MAJCOM at the same time. This broad proof of concept would precede Air Force-wide implementation in FY06. Though there is still much to learn and do, we are very optimistic about the benefits this improved logistics process will bring to the warfighter.

Demands for Parts During Operation Iraqi Freedom—How Well Did We Forecast?

How well does the Air Force predict the demand for aircraft spare parts that will be ordered in wartime? It is impossible to predict the demands accurately for a given item at a specific location—but what about the overall trends? Are our demand forecasts high, low, or in the ballpark? Are there significant outliers? This study assessed the expected wartime demands against the items actually demanded during Iraqi Freedom.

The data used in the evaluation were obtained from several sources. A US Central Command Air Forces report identified the weapon systems used during Iraqi Freedom. We were not able to determine the exact readiness spares packages (RSP) used in Iraqi Freedom, so we selected RSPs that were designed to support the number and type of aircraft involved. RSP data were obtained from the 2002 contingency kits in the D087G data system (Weapon System Management Information System, Requirements and Execution Availability Logistics Module). Demand data from 19 March through 18 April 2003 were obtained from the SBSS. The demands specify the quantity of items ordered by bases. Iraqi Freedom demands (immediate issues, kit issues, and back orders) were identified by project code 9GJ. We were advised that there was confusion regarding which project code to use during the first 2 weeks of the operation, so we elected to count all base demands as Iraqi Freedom demands if at least 25 percent of a base's total demands were coded 9GJ. Expected demands for 30 days of war, calculated from RSP data, were compared against Iraqi Freedom demands recorded in the SBSS for the first month of the war.

This study focused on all items contained in RSPs except not optimized items, because valid demand rate predictions are not available for these type items. For items considered, we found more than 1,900 unique stock-numbered items were ordered between 19 March and 18 April 2003. The total quantity ordered across those parts was 5,544. We discovered many items were overpredicted or underpredicted significantly during the operation, with most being overpredicted. Figure 1 shows that only 20 percent of the expected demands actually occurred. Further, 2,248 demands were unexpected based on RSP demand projections.

The quantity of unexpected demands did not seem unusual, since it is impossible to predict component failures accurately—and the vast majority of underpredicted items had small differences between expected and actual demands. On the other hand, the large number of overpredicted demands was surprising. Further analysis of the overpredictions showed that the majority of parts were not overpredicted by very much, although there were some parts with very large differences.

Modeling Issues	COLT for Bases	COLT for Depots
Objective function	Meet performance target	Meet financial target
Order quantities	Account for EOQ	Account for daily ordering (no EOQ)
Part essentiality	Always stock MICAP-causing parts	Not considered

Table 1. Base-Unique Changes

Base	EBO—SBSS	EBO—COLT	% Change
Seymour Johnson	32,810	11,181	-65.9
Travis	9,036	2,859	-68.4

Table 2. Expected Back Orders

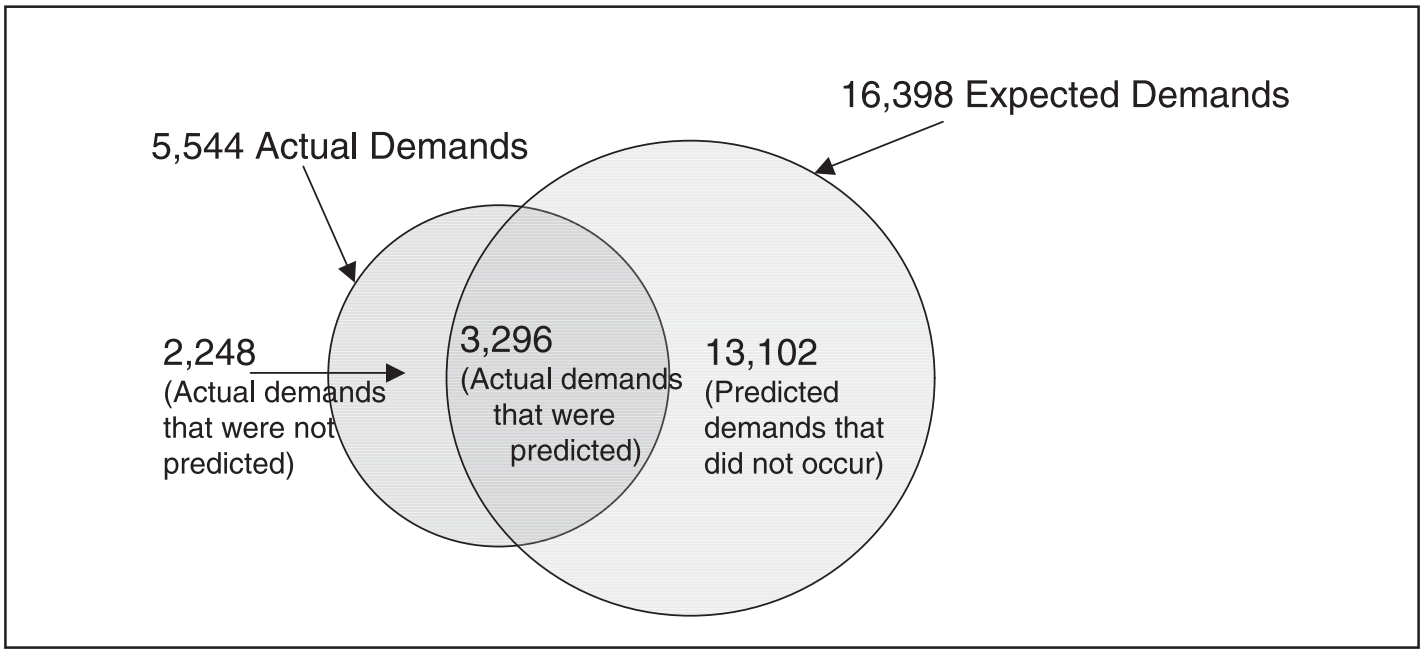


Figure 1. Actual Expected Demands

While the bulk of RSP-computed items was overpredicted, there were underpredicted items as well, as indicated in Figure 2. Most of the items were underpredicted by ten or fewer.

These data can help with evaluation of the processes used to predict wartime demands to see if improvements can be made. Again, demand predictions will never be precise, especially in a wartime environment, but it may be possible to reduce the magnitude of the discrepancies. A more detailed report and demand data file are available upon request.

Supply Chain Metrics—Relating Supply Measures to Warfighter Capabilities

Metrics drive behavior. It is understood that measuring the performance of a process and reporting the results to senior leaders can drive improvements to the process. In the case of Air Force supply, there are a host of measures that historically have been used to report the health of the supply system. Most people acknowledge that the ultimate supply measure is total not mission capable due to supply (TNMCS), as it measures the amount of time a weapon system is grounded because of a lack of spare parts. But TNMCS is a measure of supply performance at the weapon system level. It does not measure the supply performance of the individual parts that can ground a weapon system. AFMC managers need supply measures related to the individual parts because different organizations and processes manage the parts. So we conducted a study to identify the supply measures most closely correlated to TNMCS.

We used the Supply Chain Operational Performance Evaluator (SCOPE) simulation model to quantify the relationship between TNMCS and the most popular supply measures.

- Customer wait time
- Logistics response time (LRT)
- Issue effectiveness (IE)
- Mission-capability (MICAP) hours

We did not directly consider two other supply measures, depot back orders and stockage effectiveness, because they are related closely to measures already considered (logistics response time and issue effectiveness, respectively). The SCOPE simulation modeled 16 different scenarios that we deemed might influence the relationships.

- Number of aircraft (large and small number of primary authorized aircraft [PAA])
- Intermediate maintenance capability (yes or no)
- Depot-to-base part transportation time (large or small order and ship time [OST])
- Complexity of weapon system (many or few parts)

Supply measures and TNMCS data were collected from each simulation for 1,000 days and for 25 different iterations. We computed correlation coefficients between each of the supply measures and TNMCS to quantify the relationship and then identified which measure was correlated most closely to TNMCS for each scenario. The results are summarized in Figure 3.

These results clearly show that MICAP hours and customer wait time are the supply measures most closely related to the ultimate supply measure, TNMCS. The AFMC Logistics Directorate used this conclusion to change the metrics used to monitor the performance of supply chain managers. Starting in FY04, the metrics will be MICAP hours and customer wait time.

Other Contributions

We helped improve Air Force supply lines in a number of additional ways in 2003. Following is a brief summary of those efforts, grouped into four functional areas.

Performance Measurement

- Developed a process to identify the parts with the greatest underforecasted demands and overforecasted demands in D200A (Secondary Item Requirements System) to focus ALC attention on improving the forecasts.
- Demonstrated for several senior leaders why supply metrics can and should differ across ALCs and supply chain managers.
- Showed the impact pipeline times have on the performance of the supply system.
- Continued development of the Wartime Supply Chain Evaluation model to forecast warfighter readiness in preparation for contingencies.
- Evaluated the supply support provided to foreign countries via our LRT analysis tool.
- Applied a new process to value Air Force spare part inventory at a moving average cost instead of the latest acquisition cost for serviceable inventory and carcass cost for unserviceable inventory.
- Showed that parts procured using a strategic sourcing concept have experienced reductions in acquisition lead time, increases in on-time deliveries, and price stabilization.

Computing Spares Requirements

- Quantified the readiness improvements the Air Force can expect from the DLA weapon system readiness improvement initiative.
- Developed a process to determine the optimal mix of AFMC GSD and Materiel Support Division funding to maximize warfighter support.
- Identified improvements to the D200A spares requirements computation to recognize the base economic order quantity for consumable parts.
- Used COLT to determine the GSD funding allocation across ALCs for FY04.
- Continued building evaluation tools for both the Air Force and DLA weapon system support programs.

Setting Stock Levels

- Demonstrated that D035E (readiness-based leveling [RBL]) can set stock levels effectively and improve support for Air Force-managed consumable parts
- Provided quarterly reports to the AFMC Logistics Directorate, showing the expected financial and readiness impacts of the quarterly RBL computations.
- Worked with the Logistics Management Institute to develop a concept for linking Air Force readiness-based sparing math models into the Advanced Planning and Scheduling (APS) demonstration at Oklahoma City ALC.
- Evaluated the forecasting accuracy of 30 different techniques from a commercial forecasting package and D200A and

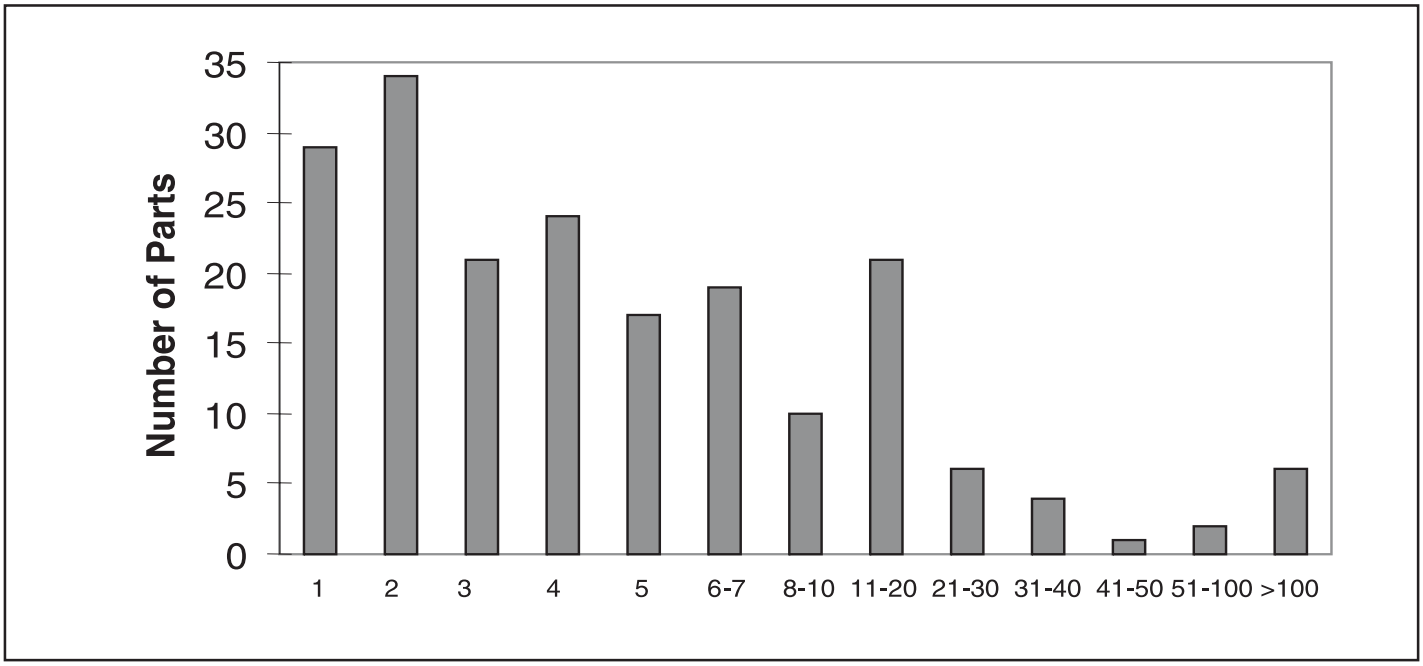


Figure 2. Magnitude of Underprediction

Metric	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
LRT																
CWT	X		X		X		X					X	X		X	
IE																
MICAP Hrs		X		X		X		X	X	X	X			X		X

Most closely correlated measure indicated by X

ID	Scenario
A	Big PAA, Maint, Sm OST, Few Items
B	Big PAA, Maint, Sm OST, Many Items
C	Big PAA, Maint, Lg OST, Few Items
D	Big PAA, Maint, Lg OST, Many Items
E	Big PAA, No Maint, Sm OST, Few items
F	Big PAA, No Maint, Sm OST, Many Items
G	Big PAA, No Maint, Lg OST, Few Items
H	Big PAA, No Maint, Lg OST, Many items

ID	Scenario
I	Sm PAA, Maint, Sm OST, Few Items
J	Sm PAA, Maint, Sm OST, Many Items
K	Sm PAA, Maint, Lg OST, Few Items
L	Sm PAA, Maint, Lg OST, Many Items
M	Sm PAA, No Maint, Sm OST, Few items
N	Sm PAA, No Maint, Sm OST, Many Items
O	Sm PAA, No Maint, Lg OST, Few Items
P	Sm PAA, No Maint, Lg OST, Many items

Figure 3. MICAP Hours and CWT Most Closely Correlated to TNMCS

highlighted the top 10 for inclusion in the APS demonstration at Oklahoma City ALC.

- Validated software changes to the D200A logic used to compute safety stock levels.
- Assisted with the calculation of RSP requirements for the joint strike fighter.

Executing Spares Requirements

- Worked with AFLMA to show that the process for reporting serviceable intransit asset data is broken—at least 36 percent of the reported intransits are overstated.
- Updated the Execution and Prioritization of Repair Support System (EXPRESS) math model to accommodate longer repair execution horizons.
- Highlighted a shortcoming in the EXPRESS prioritization of current maintenance back orders and obtained corporate Air Force approval to implement an improvement.
- Participated as a member of the AFMC Purchasing and Supply Chain Management Integrated Product Team to develop seamless and transparent purchasing and supply chain management processes.
- Evaluated a proposed closed-loop planning process and associated analytical model developed by RAND and qualified its role in helping AFMC support the warfighter through improved depot resource planning.

Mr Moore is Chief, Analytic Applications Function, Management Sciences Division, Headquarters Air Force Materiel Command, Wright-Patterson AFB, Ohio.

AIR FORCE JOURNAL of LOGISTICS

Volume XXVII,
Number 4
Winter 2003

Contacting the Journal Staff

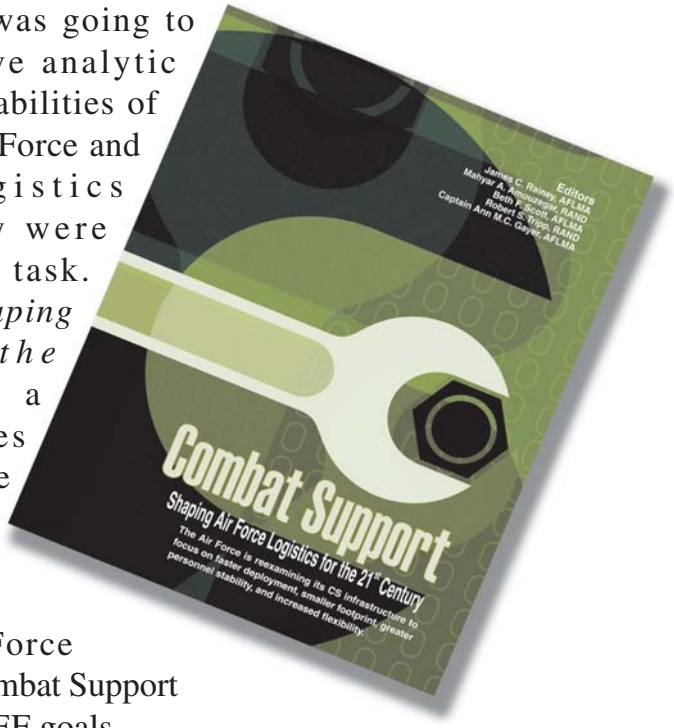
We've relocated to temporary facilities at Maxwell AFB, Alabama, while our permanent home is undergoing rennovation. Planning is for a return to the Gunter Annex address in late 2004. Our temporary address and phone numbers are listed below.

50 Chennault Circle
Maxwell AFB AL 36112-6417
Commercial 334 953-0885/0889/0890
DSN 493-0885/0889/0890

Available Now

NEW!

In 1996, shortly after Operation Desert Strike, concern about the long-term requirements of enforcing the no-fly zones, including covering *the carrier gap,* led to the initial concept of an air and space expeditionary force. At that time, the Deputy Chief of Staff, Operations, Lieutenant General John P. Jumper, realized that transforming the Air Force to a more expeditionary footing was going to require comprehensive analytic study. The unique capabilities of both RAND Project Air Force and the Air Force Logistics Management Agency were harnessed to take on this task. *Combat Support: Shaping Air Force Logistics for the 21st Century* is a compilation of articles that communicates the essentials of the analyses completed over the last 6 years. The research was conducted to help the Air Force configure the Agile Combat Support system in order to meet AEF goals.



The Editorial Advisory Board selected "German Wonder Weapons: Degraded Production and Effectiveness"—written by Major Todd J. Schollars—as the most significant article to appear in Vol XXVII, No 3 of the *Air Force Journal of Logistics*.